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ACCOMPLISHMENTS OF SCIENTIFIC RESEARCH IN THE MINISTRY OF THE ENVIRONMENT

EXTERNAL

GRANTS AND CONTRACTS

APRIL 1983

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1983

Ontario
Ministry
of the
Environment

The Honourable
Keith C. Norton, Q.C.,
Minister

Gérard J. M. Raymond
Deputy Minister

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ACCOMPLISHMENTS
OF SCIENTIFIC RESEARCH
IN THE
MINISTRY OF THE ENVIRONMENT

GRANTS AND CONTRACTS

PART I - FUNDED FROM PROVINCIAL LOTTERY PROCEEDS
PART II - FUNDED FROM THE MINISTRY REGULAR BUDGET

APRIL, 1983

POLICY AND PLANNING BRANCH

PREFACE

The purpose of this report is to provide the public and scientific community with a summary of Ministry research projects undertaken externally. There are two sources of funds: 1) proceeds from the Provincial Lottery; and 2) the Ministry regular budget.

Scientific research is making a growing contribution to the solution of Ontario's increasingly complex environmental problems. The Ministry research effort has been strengthened by a consolidation of research planning as part of the strategic planning process. The process requires Ministry specialists to identify research needs, which are then applied to the selection and development of research projects. The planning encourages research that is predictive and orientated towards significant issues and the speedy application of results. The projects are conducted by Ontario universities and consultants, and funded through grants and contracts.

MOE GOAL STATEMENT:

"To achieve and maintain a quality of the Environment--including air, water and land--that will protect human health and the ecosystem and will contribute to the well-being of the people of Ontario."

Technology Transfer

The research program has laid particular stress on technology transfer and utilization of research results. Annual conferences held over the last three years have attracted a total audience of one thousand, representing university, government, industry, private consultants and environmental groups. Ministry staff have benefited by their attendance, and new projects funded by the Ministry have been generated.

Technology transfer has also been helped by the fact that funding of a number of projects has been shared with the Ontario Ministries of Health, Labour and Agriculture, with the Federal Department of National Health and Welfare, and with several municipalities. Good contacts are likewise maintained with researchers in other regions and countries.

The report is presented in two parts:

Part I - Research projects funded between 1977-83 from the Provincial Lottery Trust Fund.

Part II - Research projects funded in 1982-83 from the regular budget of the Ministry.

PART I

ACCOMPLISHMENTS OF SCIENTIFIC RESEARCH FUNDED FROM THE MINISTRY OF THE ENVIRONMENT'S PROVINCIAL LOTTERY TRUST FUND, 1977-83

EXTERNAL GRANTS AND CONTRACTS

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Introduction

The last decade was marked by a growing concern on the part of both public and government as evidence showed that public health and the natural environment were threatened by contaminants of a hazardous nature. Scientific knowledge and traditional technologies of pollution control were found to be lacking.

Since 1977, the Government of Ontario has distributed a portion of the proceeds from the Provincial Lottery to the Ministries of Health, Labour, and Environment. The Ministry of the Environment has used its share to initiate a comprehensive program of health-oriented environmental research and clean-up projects to remove health hazards caused by environmental contamination.

This report describes the program in brief and outlines its accomplishments so far.

Financial Information

Since 1977, proceeds from the Provincial Lottery amounting to $9.0 million have been dedicated to the program, which is administered by the Ministry Research Advisory Committee.

A total of 222 proposals have been submitted for consideration and review by the Committee, and 62 were approved by the Minister for funding.

The employment generated by the research projects, based on information contained in project applications, is 86 man-years. Many additional jobs were created from the labour intensive clean-up contracts.

Annual Allocations and Expenditure of Funds

	Allocation	Expenditure	
1977-78	$1,000,000	$ 724,800	
1978-79	2,100,000	1,911,400	
1979-80	2,700,000	2,628,300	
1980-81	1,800,000	1,799,800	
1981-82	900,000	899,900	
1982-83	846,800	846,800	(projected)
	$9,346,800	$8,811,000	

A total of $936,000 will be needed to complete projects already underway in 1983-84.

The funds have been distributed as follows:

Performed	No. of Projects	% of Total Funds
Research by Universities and Colleges	31	38.4
Research by Contractors and Consultants	19	25.4
Research by Ontario Research Foundation	3	6.8
Research by Municipalities	4	10.0
Cleanup by Contractors	4	19.4

The following Ontario Universities have participated in this program: Lakehead, Laurentian, Western, Waterloo, Guelph, McMaster, York, Toronto and Ottawa.

Summary of Project Spending and Accomplishments

Project Spending

Projects have been directed towards the solution of health-related environmental issues with a particular focus on hazardous contaminants. They are summarized in the following table:

			Funding	
Project Classification & Project Activity	No. of Projects	% to Total Projects	Cost X$1000	% Cost to Total
1) Cleanup of Hazardous Contaminants & Spills	4	6.5	1603.1	18
2) Research to Develop Cost Effective Technology for Improvement in:				
2a. Drinking Water	9	14.8	858.4	9.7
2b. Sewage & Sludge Treatment	9	14.8	830.9	20.6
2c. Landfill Construction & Operation	4	6.5	434.7	4.9
2d. Air Quality Effects on Health	7	11.5	1033.3	11.6
2e. Water Quality Effects on Health	3	4.9	39.9	0.5
Sub-total	32	52.6	4197.2	47.3
3) Research to Control Health Hazards from Contaminants				
3a. Hazardous Contaminants and their Interaction	20	32.8	2684.0	30.2
3b. Analytical Procedures	5	8.2	399.6	4.5
Sub-total	25	41.0	3083.6	34.7
TOTAL	61	100.0%	8883.9	100.0%

Accomplishments

Development of Improved Methods of Cleanup of Hazardous Contaminants and Assistance towards Cleanup Operations

- Lead deposition around smelting plants (jointly with Toronto lead smelters).
- Radiation contamination of houses at Elliot Lake and Bancroft (jointly with the Federal Government).
- Identification of mine tailing sites and estimation of potential hazard.

Drinking Water

- Removal of hazardous contaminants by activated carbon and by improved alum treatment techniques.
- Use of ozone for disinfection without production of hazardous contaminants i.e. chloroform and other chlorinated substances.
- Improved virus identification techniques.

Sewage and Sludge Treatment

- Development of artificial marsh for sewage treatment (jointly with Municipality).
    - Techniques for construction of cat tail marsh treatment operation established.
    - Operational methods were established.
    - Similar facilities now being planned in small communities at significant savings over conventional systems.
- Provided data on effects of sludge on agricultural land, allowed development of new sludge disposal policy, and reduced the cost of excessive use of synthetic fertilizers.
- Demonstrated benefits of sewage effluent disinfection to downstream water users.

Landfill Construction and Operation

- Provided data on attenuation of metals in landfill leachate by soils.
- Provided data on methane gas migration at closed landfill sites, required in setting land use criteria.

Landfill Construction and Operation (continued)

- Air quality effects on health.
- Determined the significance of road dust in air pollution.
- Pulmonary tests on children living above and below Hamilton Mountain showed significant correlation between air quality and respiratory morbidity, particularly indoor-outdoor environment.

Health Hazards from Contaminants

- Tested alternate PCB substitutes and demonstrated minimal environmental health effects.
- Developed improved biological testing methods for the identification of carcinogenic chemicals.
- Identified normal body burdens of Lead and Cadmium in vital body organs allowing better evaluation of abnormal levels.
- Demonstrated an alternate technique to pesticide application by the sterilization of breeding females for the control of onion maggots.
- Developed improved analytical procedures for the identification and quantification of contaminants.

SUMMARIES OF INDIVIDUAL PROJECTS

1 - CLEANUP OF HAZARDOUS CONTAMINANTS AND SPILLS

1. Cleanup of Hazardous Contaminants and Spills

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
1	"Replacement of Lead Contaminanated Soil Around Three Secondary Lead Smelters."	Sheridan Nurseries, Toronto.	To replace lead contaminated soil causing a potential health hazard in populated areas.	$83,200 1977	Completed 1977. Replacement of the soil eliminated the danger.
2	"Environmental Clean-up of Inactive and Abandoned Mining Properties."	MOE	- Survey of abandoned mining locations in Ontario. - Assessment of environmental impact and health hazards. - To recommend remedial and control technology.	$94,300 1977	Completed in 1979. Report documents the nature and extent of environmental problems with recommendations for remedial measures.
7	"Radiation Control Measures in Elliot Lake."	Atomic Energy of Canada	- Reduction of radioactivity in affected properties. - Reduction of radon-causing potential health hazards in residents.	$1,206,100 1977-1980	Completed 1980. $1.3M additional cost covered by AEC. - Remedial work included 480 residential properties. - Continued with MOE non-Lottery funding.

1. Cleanup of Hazardous Contaminants and Spills

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
9	"PCB Cleanup and Assessment near Dowling, Ontario."	Geocon Ltd.	Assessment of environmental impact on soil and water caused by PCB spill - CPR train accident near Dowling: PCB-soil-water interaction, and potential health hazard.	$219,500 1977-1980	Completed in 1980. Results were used to: contain contaminated soil (concrete enclosure), protect public health, resolve the issue.

2 - RESEARCH TO DEVELOP COST EFFECTIVE TECHNOLOGY FOR IMPROVEMENT IN

2a Drinking Water

2b Sewage and Sludge Treatment

2c Landfill Construction and Operation

2d Air Quality Effects on Health

2e Water Quality Effects on Health

2a Drinking Water

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
4	"Detection, Enumeration and Interpretation of Levels of Virus in Drinking Water and Bathing Waters."	University of Ottawa	To identify types and levels of virus in Ottawa River water sewage effluents, Brittania Beach water and water entering the Treatment Plant.	$92,600 1977-80	Completed 1980. Information gained can be used for interpretation of virus data, and in the development of Guidelines.
8	"Chloroform Reduction Investigation Program at Belleville Utilities Commission."	Belleville Utilities Commission, Gore & Storrie Ltd.	To apply laboratory-developed techniques for reduction of chloroform produced during chlorine disinfection of drinking water.	$83,900 1977-80	Completed 1980. The results will be used in the design of Belleville Water Treatment Plant and in the method of testing other supplies.
21	"Organic Contaminants Removal from City of Brantford Drinking Water."	Brantford Public Utilities & Enviroclean Ltd.	To examine the use of activated carbon to remove several organic compounds from drinking water using a pilot scale treatment facility.	$37,000 1978-80	Completed 1980. The project has demonstrated the effectiveness and adaptability of the method for safe drinking water production.

2a Drinking Water

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
27	"Ozone Application as an Alternative to Chlorine for Drinking Water Disinfection." (Project LS-21)	International Environ. Consultants Ltd.	To study the effectiveness of ozone treatment of drinking water as a substitute for chlorine. Cost estimates of ozonation to be made.	$214,700 1979-1982	Completed 1982. Report expected 1983. Paper presented at Technology Transfer Conference. The results are important for MOE efforts to provide safe drinking water and eliminate health hazards.
29	"Biomonitoring of Public Water Supplies."	International Environ. Consultants Ltd.	Fish from the Grand River were used to study their exposure to organic contaminants in raw water supplies.	$214,600 1979-81	Completed 1981. The use of fish to monitor drinking water was demonstrated. Direct computer analysis of data can be used as an alarm indicator for spills.
41	"Bruce Hydroelectric Thermal Plume Definition Flights."	Intertech. Remote Sensing Ltd.	To provide a synoptic view of the plume at Bruce Generating Plant relative to ambient Lake Huron temperature using low and high altitude flights.	$14,500 1979-81	Completed 1981. The study provided a continuous thermal definition of the total plume.

2a Drinking Water

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
53	"A New Potable Water Treatment Method for Trihalomethane Precursor and Synthetic Organic Removal."	Zenon Environ. Enterprises Ltd.	To develop adsorbents for treatment of drinking water and study their efficiency to remove organics prior to recommending pilot plant design.	$30,000 1981-83	In progress. Funded in partnership with Health and Welfare Canada. A paper was presented. The results will complement MOE studies on safe drinking water.
62	"Investigations of Nitrate Distributions and Nitrogen Transformations in a Shallow Sandy Aquifer near Alliston, Ontario."	University of Waterloo	To study nitrate contamination of domestic well water, and develop an alternate groundwater nitrate removal procedure.	$141,100 1982-85	In progress. Reporting date is 1985. The findings will be used to reduce or eliminate the problem of nitrate contamination of domestic well water in agricultural areas of Ontario.
63	"Design of Groundwater Monitoring Programs for Waste Landfill Sites."	University of Toronto	To apply statistical methods and models to monitoring groundwater quality at various landfill sites.	$30,000 1982-85	In progress. Reporting date is 1985. This matter has been a major issue for MOE. The results will be used for monitoring groundwater quality causing public concern.

2b Sewage & Sludge Treatment

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
12	"Disposal of Sewage Sludge on Agricultural Land."	University of Guelph	To determine long-term effects of sewage sludge application to agricultural land with emphasis on the quality of crops.	$304,300 1978-80	Completed in 1980. Results were used to assess the use of sewage treatment wastes as fertilizers without causing adverse effects to human health and animal.
13	"Effects of Applying Digested Sewage Sludges to Agricultural Land Lysimeter Studies."	Rush Engineering Services	- To define long-term maximum allowable sludge application rate to agricultural lands. - To compare results with Guelph field data.	$104,200 1978-81	Completed in 1981. Maximum allowable sludge application rate to farmland was determined and incorporated in Guidelines.
18	"Development of an Experimental Marsh Treatment Facility at Listowel, Ontario."	Gore & Storrie Ltd.	To establish a pilot marsh sewage treatment system at Listowel.	$335,300 1979-82	Completed in 1982. Design report prepared. The Ministry is currently using this facility to establish its efficiency and cost effectiveness for sewage treatment and further applications.

2b Sewage & Sludge Treatment

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
28	"Effect of Hydraulic Characteristics and Effluent Chlorination on the Incidence of Microorganisms of Public Health Significance in Waters Receiving Sewage Treatment Plant Effluents."	Beak Consultants Ltd.	- To study the effect of chlorination on bacteria in sewage effluents. - To investigate the feasibility of using bacteria as indicators.	$278,700 1979-82	Completed in 1982. Monitoring of bacteria in effluents is now possible to protect public health. Use of bacteria to replace indicator organisms may be more efficient.
30	"Kennedy-Burnett Urban Stormwater Runoff Treatment Study." (In conjunction with Project #37). Partners: Environment Canada, Cities of Ottawa & Nepean, Municipality of Ottawa-Carleton.	Regional Municipality of Ottawa-Carleton	- To determine the efficiency of treatment of urban stormwater and to characterize the quality and quantity of urban runoff.	$100,100 1979-81	Completed in 1981. A monitoring system has been developed. The data is in support of the proposed impoundment technique as a means of treatment of stormwater runoff.
37	"Rideau River Stormwater Management Study, Ottawa, Ontario." Partners: Environment Canada, Cities of Ottawa & Nepean, Regional Municipality of Ottawa-Carleton.	Regional Municipality of Ottawa-Carleton	- To improve water quality in the drainage area of the Rideau River, to allow for improved recreational activities and reduced health hazards.	$650,000 1979-83	In progress. Reporting date is 1983. Total cost = $1,434,000 The study will result in a comprehensive stormwater management plan for the Rideau River and has potential use throughout Ontario.

2b Sewage & Sludge Treatment

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
46	"Compilation of Summation Report on Nine Years of Research Studies on the Disposal of Sewage Sludge on Agricultural Land."	University of Guelph	To assess the results of field, greenhouse and laboratory studies of the application of sludges to farmland including environmental effects and trends.	$11,500 1980-81	Completed in 1982. The report provides valuable information on the use of sewage sludge as fertilizer and related Canada-Ontario Agreement studies over the last nine years.
54	"Application of Ultraviolet Disinfection Technology in Ontario WPCP Effluents."	Standard Biological Laboratories Ltd.	A pilot scale UV disinfection unit will be used to establish the efficiency and performance of the method applied to sewage effluents.	$41,000 1981-83	In progress. Report is expected in 1983. The results will be used to establish UV design guidelines for disinfection of sewage treatment effluents and eliminate health hazards.
57	"Assessment of the Potential for Dissemination of Environmental Contaminants by Treatment of Waste Water in Lagoon Systems."	Limnos Ltd.	Literature and unpublished data on contaminants in sewage lagoons will be evaluated.	$5,900 1981-82	Completed in 1982. Insufficient data on the danger of transfer of contaminants in sewages to the foodchain has been noted and further studies were recommended for the protection of public health.

2c Landfill Construction and Operation

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
16	"Sanitary Landfill Site Investigation at Canadian Forces Base, Camp Borden."	University of Waterloo	- To develop methods for leachate monitoring and their application to groundwater geochemistry. - To evaluate the process of anerobic decomposition using mathematical models.	$36,200 1978-80	Completed in 1980. The planned objectives were achieved. The information obtained on patterns of organic and inorganic contaminants will be valuable in MOE present landfill site identification strategy.
23	"The Study of Gas Production and Migration at Closed Landfill Sites."	Hydrology Consultants Ltd.	- To study the production and control of gas at sanitary landfills. - To establish a data base of gas migration at selected sites with emphasis on development of regulations for land use.	$252,800 1979-82	Completed in 1982. The objectives were achieved. The data obtained are valuable in setting criteria for use of land close to previous dump sites for urban development. This activity is now part of the Waste Management program in MOE.
44	"Attenuation in Groundwater of Inorganic Contaminants from Sanitary Landfills, Attenuation of Leachate."	University of Waterloo	To investigate the attenuation of contaminants in groundwater at selected landfills in North Bay and Waterloo. Contaminant profile maps will be produced.	$116,000 1979-82	Completed. Reporting date is 1983. Public concern for groundwater contamination near landfills is well known. The results, especially the contaminant maps, will provide predictive data for policy making.

2c Landfills Construction and Operation

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
58	"Field Measurements Infiltration through Landfill Covers."	Gartner Lee Ltd.	To study infiltration of water through various types of cover materials used in the construction of landfill sites. Field data will be collated for one year and verified for reliability.	$29,700 1982-83	In progress. To be completed in 1983. The anticipated results will assist MOE in preventing infiltration of hazardous contaminants, possibly present in landfills, to groundwater.

2d Air Quality Effects on Health

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
15	"An Investigation of the Health and Welfare Effects on Noise in Ontario."	SNC/GECO Canada Inc.	To investigate the health effects of noise at 25 selected sites near railways, highways, industry and airports using social surveys, audiological testing and health records.	$51,400 1978-79	Completed in 1980. The results are helpful in policy setting and remedial action for noise reduction in Ontario.
17	"A Study on the Relationship between Hospital Admission Rates for Acute Respiratory Illness and Air Quality in Several Ontario Cities."	University of Toronto	To correlate hospital admission for acute respiratory dieases with air pollution.	$1,000 1978-79	Completed in 1979. Air pollution data were provided by Federal and Provincial organizations.
20	"Epidemiological Study to Determine the Health Effects of Particulates and SO_2 Level (and other gases) in Air."	McMaster University	- To study the effects of indoor and outdoor air contaminants on children's pulmonary function. The survey included socio-economic factors.	$516,400 1978-81	Completed in 1981. Report in preparation. $516,400 additional funding paid by Health & Welfare. MOH was a partner in 81/82. Children at schools, homes, hospitals, etc. in Hamilton were examined for respiratory effects of air pollutants.

2d Air Quality Effects on Health

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
32	"A Study to Evaluate Urban Road Dust as a Source of Suspended Particulates."	Ontario Research Foundation	To determine the contribution of urban dust to particulate matter concentrations in Hamilton.	$182,000 1980-82	Completed in 1982. $275,000 additional cost covered by Environment Canada, Stelco, and Dofasco. Cleaning methods assessed and cost effective urban dust control strategies developed.
40	"Effects of Ambient Air Pollution (Assessed by Personal Indoor and Outdoor Monitoring) on Humans."	Gage Institute, University of Toronto.	To assess health effects of air pollution using personal monitors for several air contaminants. 90 asthmatic and non-asthmatic cases were evaluated.	$99,500 1979-82	Completion date is 1983-84. $200,600 additional funds were granted by Health & Welfare and the U.N. World Health Organization. A portable personal monitor was developed for assessment of human exposure. Report has been received.
47	"Investigation of Sleep Disturbance Effects of Road Traffic Noise."	Wilson & Associates	To determine the relationship between road traffic noise and sleep disturbance and their effects on public health. Literature information will be reviewed and recommendations presented.	$153,000 1980-84	In progress. To be completed in 1984. The anticipated results would assist in reviewing noise criteria and predicting effects of noise levels on humans.

2d Air Quality Effects on Health

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
56	"Controlling Sulphur Dioxide Emissions. What Are The Costs?"	University of Toronto	To examine the economics of SO_2 emission control in Sarnia or Nanticoke industrial complexes. Enforcement and abatement policies will be examined.	$30,000 1981-present	In progress 1983. Comparison between alternative pollution control enforcement policies will focus on cost effective method for SO_2 reduction.

2e Water Quality Effects on Health

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
6	"The Spread of St. Louis Encephalitis through Avian & Rodent Reservoirs."	University of Toronto	To determine the role of rodents as possible virus carriers and the possibility of disease transfer by migrating birds.	$7,900	Not completed due to death of investigator. Report received in 1977. Completion of the project would assist in developing spraying programs for control of mosquitos.
45	"Continuation of Funding for the Virology Component of the University of Toronto Epidemiology Study of Bathing Beaches and Recreational Waters."	University of Toronto	To conduct epidemiological studies on illness caused by pathogens and viruses in bathing waters. Sewage Treatment Plant influent and effluents will be tested.	$17,000 1980-81	Completed 1982. In partnership with Health & Welfare Canada. The study showed that STP effluents are major sources of viruses.
60	"The Epidemiology of Swimming-Related Illness at Selected Conservation Areas."	University of Toronto	To determine the relationship between micro-organisms and viruses and bathing illnesses at selected conservation beaches using established virus detection procedures.	$15,000 1982-83	In progress. Reporting date is 1983. The anticipated results would assist in reviewing recreational water quality standards for the protection of public health through a Working Group in MOE.

3 - RESEARCH TO CONTROL HEALTH HAZARDS FROM CONTAMINANTS

3a. Hazardous Contaminants and their Interaction.

3b. Analytical Procedures.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
3	"Bioaccumulation Rates, Acute and Chronic Effects of Five New Dielectric Fluids on American Flagfish."	Lakehead University	To study fish toxicity from exposure to various dielectric fluids.	$222,100 1977-80	Completed in 1980. Work done in cooperation with Ontario Hydro. Toxicity tests on fish were carried out and the use of dielectric fluids was evaluated for replacement of PCB's.
5	"An Investigation of the Environmental Health Hazards Associated with Road Oiling."	Love Associates	To test dust-suppressant material, evaluate the "Road Oil" process and its effects on soil, vegetation and aquatic life.	$134,000 1977-79	Completed in 1979. Partnership with Min. of T. & C. Waste Oils were found inefficient for dust control.
10	"Chemical Identification and Biological Assay of Airborne and Waterborne Mutagens (Carcinogens)."	York University	- To apply new sensitive bio-hazard tests to air and water samples. - To determine toxicological effects of hazardous contaminants and chemical mixtures.	$365,300 1978-80	Completed in 1980. The work involved testing of carcinogenic effects on bacterial and mammalian cells. Successful completion has resulted in the undertaking of further studies.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
11	"Province-Wide Quantity/ Location Inventories and Emission/Discharge Inventories for Specified Chlorinated and Aromatic Hydrocarbons."	Acres Consultants	- To assess public exposure to hazardous contaminants. - To provide inventories of quantities, location, emissions, and discharges throughout the Province.	$173,100 1978-80	Completed in 1980. Emission discharge of 14 chemicals was below the hazard level. Continuous monitoring by MOE would ensure community safety.
14	"A Study of Atmospheric Mercury Deposition in Ontario."	Ontario Research Foundation	To collate data on mercury levels in air and estimate total deposition in Ontario. Mobile laboratory tests were carried out on site in Toronto and Huntsville.	$235,200 1978-81	Completed in 1981. No long-range transport of mercury was found.
19	"Environmental Assessment Study on Uranium and Other Elements in Plants around Ontario Uranium Mines."	Laurentian University	To test various environmental materials for uranium contamination using newly developed analytical procedures.	$20,000 1978-80	Completed in 1980. The funding provided base-line data on uranium which indicated local source deposition. Absence of long-range transport deposition is favourable for public safety.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
22	"Effects of PH on Mercury Accumulation in Fish."	J. Maclaren Ltd.	To establish the effect of acidity in mercury uptake by lake fish.	$45,500 1978-81	Completed in 1981. Environment Canada supplied test equipment. No unusual fish uptake of mercury was found to confirm an effect from acidity.
24	"Monitoring Fish Population in Acid Stressed Lakes of the Haliburton Region."	University of Toronto	To determine type and population of fish exposed to contaminants leached in acidic lakes.	$183,800 1978-79	Completed in 1980. Damage to aquatic biota was reported, and methods for fish rehabilitation were recommended.
25	"The Chemical Destruction of Hazardous Polychlorinated Organic Compounds: A Feasibility Study."	University of Waterloo	To examine a new method for destruction of some hazardous organic chemicals such as PCB's.	$18,100 1978-79	Completed in 1980. Laboratory experiments were successful. However, a patent has been issued to another researcher for this process.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
26	"Increased Disease Susceptibility After PCB Exposure."	McMaster University	Laboratory mice were exposed to PCB's and dioxins and the effects of exposure assessed. This has implications for the protection of human health.	$50,800 1979-81	Completed in 1981. Equal funding was paid by the Ministry of Labour. The importance of the project led to its extension; refer to Project 50.
33	"The Identification of 'Abnormal' Values of Lead and Cadmium in Autopsy Material of Occupationally Exposed Individuals."	University of Waterloo	To establish normal levels of lead and cadmium for various groups using selected autopsy tissues of females and males.	$99,000 1979-81	Completed in 1982. Normal levels of lead and cadmium due to diet, environmental and occupational exposure are controversial. The results of this study will be useful in Risk Assessment and Standard Setting.
34	"Surface Photochemistry of Pollutants."	University of Western Ontario	To establish the photochemical processes of selected hazardous chemicals in air.	$152,000 1979-81	Completed in 1982. The behavior of toxic contaminants in air, such as dioxins, etc. were studied.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
36	"Assessment of the Availability and Cost of Providing Off-site Third Party Liability Coverage Protection from Damage from Disposal Facilities."	G.T.G. Scott Consultants	- To determine the cost of environmental impairment insurance liability due to waste disposal sites. - To assess economic impact of obligatory insurance.	$3,300 1979-80	Completed in 1980. As reported, the economic impact of low-cost insurance to disposal facility operators was presented to MOE.
42	"Development of Non-Chemical Approaches to Pest Control (Sterile Male Onion Maggot Technique)."	University of Guelph	To construct a facility for pest control studies. 300 acres of onions in Keswick will be used for field testing.	$237,500 1980-83	In progress. Reporting date is 1984. In cooperation with M A & F and Agriculture Canada. Successful demonstrations are being made for control of pests without the use of toxic chemicals and pesticides.
43	"Phase II of an Environmental Assessment Study on Uranium and Other Elements in Lichens and Mosses from Elliot Lake, Ontario."	Laurentian University	To analyze previously collated data and relate to contaminants plant uptake. Improvement of detection sensitivity and reliability of data have been carried out.	$89,700 1979-81	Reporting date is 1982.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
48	"Review of Literature and Biological Testing Protocol Required for Multiple Toxicity Evaluation Pertaining to Hazardous Organic Compounds."	Lakehead University	To carry out an extensive literature search on aquatic toxicity of hazardous contaminants.	$10,900 1980-81	Completed in 1981. The review is in use in conjunction with Project No. 49.
49	"Aquatic Toxicity Studies of Multiple Organic Compounds." (Project HC-7)	Lakehead University	To determine aquatic toxicity of selected hazardous contaminants to fish. Application to industrial organics will also be carried out.	$170,200 1980-84	In progress. Reporting date is 1984. Partially funded from Hazardous Contaminants Funds. The results will be used for setting of environmental standards and fish consumption limits.
50	"Increased Disease Susceptibility after PCB Exposure."	McMaster University	See Project No. 26.	$62,300 1981-83	In progress. Lack of funds has prevented further MOE partnership. The reduction was covered by $69,120 from MOE Hazardous Contaminants Funds. The obtained information will be extremely valuable for understanding exposure to hazardous chemicals.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
55	"Chemical Identification and Biological Assay Studies of Environmental Mutagens, Promoters, and Inhibitors." (Project HC-4)	York University	- To determine mutagenic and carcinogenic activities of hazardous contaminants using newly developed methods. - To determine biohazards of individual and mixtures of contaminants.	$402,800 1981-84	In progress. Partially funded from the Hazardous Contaminants budget ($50,000). Completion date is 1984. This information is essential for the establishment of health hazard, risk, standards and criteria of contaminants in air, water and waste.
59	"Literature Searches Regarding the Potential Genotoxic Hazards of Specific Environmental Contaminants."	York University	To collate literature information on carcinogenicity and biohazards of hazardous contaminants possibly present in sewage, leachates, industrial wastes and drinking water.	$8,400 1982-83	To be completed in 1983. The information obtained will assist MOE in setting objectives for several studies, and would provide an awareness profile of hazardous contaminants.

3b Analytical Procedures

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
31	"Characterization and Identification of Organic Substances in Drinking Water."	O.R.F.	To develop new concentration techniques for the detection of hazardous organic chemicals in drinking water.	$200,000 1979-81	Completed in 1981. The levels of organic chemicals in drinking water are exceedingly low. The results are used to improve the Ministry's capabilities and to improve public confidence in MOE data.
35	"Field Evaluation of Event Precipitation Samplers for Use in the Acidic Precipitation in Ontario Study."	United Technology	To design a precipitation sampler and test its reliability.	$53,600 1979-80	Completed in 1981. Although the sampler was designed for collection of snow for acidic precipitation, its use can be extended to measure contaminants washout.
39	"The Measurement of Total Organic Chlorine in Industrial Wastes."	McMaster University	To establish analytical methods for organic chlorine in various environmental samples.	$78,800 1979-81	Completed in 1982. A paper was presented at the MOE Technology Transfer Conference. A report is expected.

3b Analytical Procedures

Project	Title	Organization	Purpose	Lottery Funding & Duration	Status/Results
61	"Development of a Methodology for the Concentration and Detection of Rotaviruses and Hepatitis A Virus in Environmental Samples."	University of Toronto	To develop sensitive methods for the detection of viruses in sewage effluent and surface water.	$49,000 1982-83	In progress. Reporting date is 1983. The information obtained will be used to assess the efficiency of Ontario Sewage Treatment Plant operation for the protection of the public from virus infections.
64	"The Development of a Freshwater Fish Test to Identify Aquatic Toxic Contaminants."	University of Guelph	To develop methods for genotoxicity testing of fish caused by aquatic contaminants.	$18,200 1982-84	In progress. Completion date is 1984-85. The developed state-of-the-art test will be used to evaluate the aquatic toxocity of hazardous chemicals.

PART II

ACCOMPLISHMENTS OF SCIENTIFIC RESEARCH FUNDED FROM THE MINISTRY OF THE ENVIRONMENT'S REGULAR BUDGET, 1982-83

EXTERNAL GRANTS AND CONTRACTS

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Introduction

Part II of the report is concerned with external research funded by the regular budget of the Ministry. In support of Ministry planning processes, the research focuses mainly on the effects of hazardous contaminants and their control, and also has an emphasis on sewage and sludge treatment and air quality.

The projects were carried out by university departments and consultants and coordinated by the appropriate Ministry branches.

Financial Information

The 74 projects listed were conducted at a cost of $3.28 million from the Ministry's regular budget.

SUMMARY OF PROJECT SPENDING IN 1982-83

Project Classification & Project Activity	No. of Projects	% to Total Projects	Funding Cost $	% Cost to Total
1) Cleanup of Hazardous Contaminants & Spills				
. Waste Disposal & Treatment	3	4.0	130,180	6.9
. Environmental Planning & Management	4	5.4	74,080	3.9
Sub-total	7	9.4	204,260	10.8
2) Research to Develop Cost Effective Technology for Improvement in:				
2a. Drinking Water	1	1.4	25,000	1.3
2b. Sewage & Sludge Treatment	5	6.8	180,700	9.6
2c. Landfill Construction & Operation	3	4.0	63,700	3.4
2d. Air Quality Effects on Health	6	8.1	241,050	12.8
2e. Water Quality Effects on Health	1	1.4	23,000	1.2
Sub-total	16	21.7	533,450	28.4
3) Research to Control Health Hazards from Contaminants				
3a. Hazardous Contaminants and their Interaction	36	48.6	772,060	41.1
3b. Analytical Procedures	15	20.3	369,900	19.7
Sub-total	51	68.9	1,141,960	60.8
TOTAL	74	100.0	1,879,670	100.0

Total cost for the full duration of the projects: $3,282,715.

SUMMARIES OF INDIVIDUAL PROJECTS

1 - CLEANUP-MANAGEMENT OF HAZARDOUS CONTAMINANTS AND SPILLS

Waste Disposal and Treatment

Environmental Planning and Management

Waste Disposal and Treatment

Waste Disposal and Treatment

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 16	"Development of an Acceptable Procedure to Allow Disposal of Pesticide Containers."	University of Western Ontario	- To introduce pesticide container rinsing technology to growers. - To evaluate rinser's efficiency. - To monitor pesticide residues in groundwater at Watford.	$31,080 1982	Reporting date - 1983. Disposal of properly rinsed pesticide containers in landfill is feasible and recommended.
WM 5	"North York Source Separation Feasibility Study."	Municipality of North York	Feasibility of collection of glass from residential areas for recycling purposes.	$11,000 1982	Reporting will be part of a feasibility study 1983. Quantities/cost analysis will be used by North York if a system is developed for the entire city.
WM 9	"Remote Sensing Techniques and Waste Management Assessment Study."	M.M.Dillon Ltd.	To develop remote sensing techniques for migration of leachates and gas at former landfill sites, mainly colour aerial and infra-red photography. Examined landfill sites: 1. Cobourg; 2. Whitby; 3. Oakville; 4. Bayview Park; 5. Upper Ottawa Street.	$88,100 1982	Completed. Two reports received in October 1982. Several remote sensing techniques were evaluated, and recommendations made re its application to leachate and gas migration studies.

Environmental Planning and Management

Environmental Planning and Management

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
WM AB 1	"Economic Benefits of Materials Recycling."	M. K. Berkowitz and Associates Ltd.	- To determine the economic benefits of material recycling. - Data from 57 urban areas will be analyzed in a specially developed computer model.	$14,980 1982	Completed in 1982. Report expected 1983. The model will indicate benefits from development of an Ontario recycling industry.
WM AB 2	"Public Involvement in Environmental Planning, Assessment and Decision-Making."	Futureplan Consulting Services	To identify structure and mechanisms for public participation in Government decision-making including public access to environmental assessment and planning.	$7,700 1982	Completed in 1982. Report expected. Various related mechanisms were studied. Recommendations are expected that could be applied to Ontario.
WM AB 4	"Development and Demonstration of an Effective Waste Reduction Program."	Resource Integration Systems & Market Facts Ltd.	To develop and test mechanisms for the reduction of residential wastes.	$43,400 1982	Reporting date is Fall 1982. Degree of public cooperation was verified by checks on garbage.

Environmental Planning and Management

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
WM 2	"Survey of Conventionally Non-Reputable High-Grade Waste Paper Fibre in Relation to Availability, Economics of Reclamation, Energy Requirements."	O.R.F.	- To survey the availability of polymer-treated waste paper. - To evaluate the economics of its recycling. - To assess the feasibility of applying an O.R.F. recycling process.	$8,000 1980-81	Reporting date is December 1982. Recommendations of a recycling process and a potential pilot plant site are expected.

2 - RESEARCH TO DEVELOP COST-EFFECTIVE TECHNOLOGY

FOR IMPROVEMENT IN:

2a. Drinking Water

2b. Sewage and Sludge Treatment

2c. Landfill Construction and Operation

2d. Air Quality and Effects on Health and the Environment

2e. Water Quality and Effects on Health and the Environment

2a. Drinking Water

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
LS 21	"Ozone as an Alternative to Chlorination for Drinking Water Disinfection." (Provincial Lottery Project No. 27)	I.E.C. Consultants	- To examine the use of ozone as an alternative to chlorine disinfection of drinking water. - To investigate the possible by-products of the two water treatment processes.	$25,000 1983	Reporting date is 1983. Funding: $25,000 from Laboratory budget, $214,680 from Provincial Lottery. Experimental work completed. Field application of ozone treatment is a feasible method for water treatment.

2b. Sewage and Sludge Treatment

2b Sewage and Sludge Treatment

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
LS 5	"Full Scale Anaerobic Digester Mixing Optimization and Loading Studies."	I.E.C. Ltd.	- Optimization of mixing performance in an anaerobic digestor at Brantford WPCP. - To establish organic and hydraulic loadings at optimum mixing.	$246,000 1980-83	In progress. Completion date is 1983. 1982-83 MOE share is $26.7K. Jointly funded by Ministry of Energy and Canada Centre for Inland Water. This project is part of MOE efforts for improvement of sewage treatment.
WM 4	"Compost Utilization."	Ridgetown College of Agricultural Technology	To determine the tolerance level for the use of sewage sludge and municipal waste composts on farmland. Effects on plant growth will be tested.	$81,500 1982-83	In progress. Completion date is 1983. Jointly funded by MOE and MOA&F. The findings would be useful in MOE sludge utilization programs. Its success is two-fold: 1. cost-effective disposal of waste; 2. reduced excessive use of synthetic fertilizers.

2b. Sewage and Sludge Treatment

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
LS 31	"Characterization of runoff quantity/quality relationships - Taylor Creek."	University of Toronto	To determine the nature and source of pollutants in runoff from a residential catchment.	$4,000 1983	In progress. Completion date is December 1983. Quantitative and qualitative analyses of runoff flows would assist in developing "pollutant budgets" for residential land use.
LS 32	"Assessment of Stormwater Detention Ponds."	York University	To determine the effectiveness of 4 stormwater detention facilities for removal of pollutants.	$8,500 1982-83	In progress. Completion date is June 1983. Joint program: MOE-York University The findings would assist in evaluating the operation and policies related to detention ponds.
LS 36	"Hazardous Contaminants in Hamilton WPCP."	Canviro Consultants Ltd.	- To estimate annual loadings of hazardous contaminants in WPCP discharges into Hamilton Harbour. - To assess contaminants' removal efficiency through analysis of season samples.	$60,000 1982-83	In progress. Completion date is August 1983. Identification of the types and quantities of hazardous contaminants in raw sewage and sewage effluents would assist MOE: 1. to establish the efficiency of treatment; 2. to use the data as "fingerprint" of possible sources of pollution in an industrial area

2c. Landfill Construction and Operation

2c. Landfill Construction and Operation

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
WM 7	"Best Pipe."	Conestoga Rovers	To assess landfill gas extraction system as a control mechanism and the use of gas in boilers at Best Pipe in Kitchener.	$14,000 1983	In progress. Completion date is 1983. Jointly funded with Ministry of Energy and Environment Canada. The assessment concentrates on use of generated gas at landfill sites with no control mechanism for its generation.
WM 8	"Gas Migration Study."	Hydrology Consultants Ltd.	- To study the production and control of gas at 9 landfill sites. Temperature, pressure and concentration will be measured. - To establish a data base of gas migration with emphasis on the development of regulations for land use.	$34,700 1982-83	Completed in 1982. Objectives achieved. Provincial Lottery funding (PL-23): $252,800. This activity is now part of MOE Waste Management Branch program.
WM 10	"Study on Landfill Research Activities."	University of Waterloo	- To examine waste classifications. - To assess processes affecting decomposition of waste. - To survey migration of contaminants, their attenuation and control.	$15,000 1982	Jointly funded with Environment Canada. Knowledge of the results might be used for optimization of gas production under control conditions as assisted by co-disposal.

2d. Air Quality and Effects on Health and the Environment

2d. Air Quality and Effects on Health and the Environment

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
AR 1	"Production of Ozone Insensitive Field Bean Varieties."	University of Guelph	Ozone tolerance of beans will be investigated in hope of production of ozone insensitive varieties.	$39,300 1980-83	1982-83 cost is $14,600. Final report expected in March 1983. Progress made was presented at ARB Seminar.
AR 5	"Development of a Strategy for Predicting the Impact of Fast Food Restaurants on the Surrounding Community."	University of Windsor	Ambient and source sampling will be evaluated including laboratory simulation.	$20,000 1981-84	1982-83 cost is $6,900. Ongoing - a model is to be developed. Progress report presented and discussed at ARB Seminar.
AR 6	"Assessment of Impact of Oxidant Injury on Potato and on the Development of Early Blight."	University of Guelph	Ozone injury to potato and the use of chemical protectants will be assessed.	$64,700 1980-82	1982-83 cost is $26,300. To be completed in 1983. Progress report expected in March 1983.

2d. Air Quality and Effects on Health and the Environment

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
HC 3	"Monitoring Genotoxicity in the Atmosphere using Sister Chromatid Exchange in Mice."	University of Windsor	To develop a straight forward procedure and ongoing monitoring of the atmosphere for agents genotoxic to a mammalian system.	$29,400 1982-83	In progress. Funding for 1983-84 is $32,000. The study will complement MOE activity in genotoxicity, hazard and risk assessments, and should assist in Standard Setting by providing the measurement technique of real-life air pollutant mixtures, using mice as representatives for the mammalian system.
HC 9	"A Mass-Spectrometric Study of Selected Air Pollutants."	Trent University	To investigate the reaction mechanism and specific rates of 9 PAH's including oxidation reactions.	$21,600 1982-83	In progress. Funding for 1983-84 is $22,000. The reaction of PAH's in air are not fully understood. The Ministry has produced a large analytical database. The obtained information, together with MOE efforts to improve PAH sampling, would assist in producing reliable data that is required for setting some guidelines. The project complements 4 MOE studies.
HC 14	"Study of Inhalable Particulate at Regional Sites."	Air Resources Branch	To test the performance of dichotomous samplers, and use them to determine the correlation between total and suspended particulate matter in air at 8 Regional industrial locations in Ontario.	$142,250 1982-83	In progress. The funds will be used to purchase 8 air samplers. ARB, together with MOE Regions, will provide other necessary resources. Purchase of equipment would increase ARB technical capabilities.

2e. Water Quality and Effects on Health and the Environment

2e. Water Quality and Effects on Health and the Environment

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
HC 7	"Aquatic Toxicity Studies of Multiple Organic Compounds." (Provincial Lottery Project 49)	Lakehead University	To determine aquatic toxicity of selected hazardous contaminants to fish. Application to industrial organics will also be carried out.	$23,000 1982-83	In progress. Completion date is 1983. Funding: Prov. Lottery $147,200 Haz. Cont. Office 15,000 H. C. Funds 8,000 Total $170,200 The study provides information on fish toxicity and leads to: 1. toxicity to fish; 2. use of fish as an indicator for pollution; 3. information on interaction of composite chemical mixtures.

3 - RESEARCH TO CONTROL HEALTH AND ENVIRONMENTAL EFFECTS FROM CONTAMINANTS:

3a Hazardous Contaminants and their Interaction

3b Analytical Procedures

3a Hazardous Contaminants and their Interaction

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
AR 9	"Evaluation of Contaminated Water and Soil Sites as Sources of Airborne Hazardous Materials."	University of Toronto	To determine the rate of volatilization of organic pollutants from water and soils.	$51,000 1982-85	Funding for 1982-83 is $17,000. - Systems were set up for partition coefficient measurements. - Water volatilization system developed. - Soil volatilization system is under development. It is too early to foresee the implementation of results.
AR 11	"Sweet Corn and Green Bean Response to Air Pollution in Southern Ontario."	University of Guelph	To determine the efficiency of chemical protectants against ozone for sweet corn and green beans.	$51,600 1982-85	Funding for 1982-83 is $15,500. In progress. A progress report is expected in March. Insufficient information available.
AR 20	"Trace Organic Contaminants."	Ontario Research Foundation and MOE	To determine dioxins and furans in all discharge streams at selected waste incinerator plants, and monitor the development of health related standards.	$380,000 1981-83	Funding for 1982-83 is $150,000. Jointly funded with Ministries of Energy and Labour. Sampling and sample preparation was contracted out to O.R.F. Sampling completed at 3 incinerators: 1. Commissioner Street, Toronto; 2. Ashbridge Bay - Toronto; 3. SWARU - Hamilton.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 1	"Smut of Fall Panicum."	University of Guelph	- To study the effect of smut on panicum and its symptoms. - To examine the potential use of smut as a biocontrol agent.	$19,000 1981-83	Funding for 1982-83 is $13,500. In progress. Progress report available December 1982.
PAC 2	"The Separate Metering of Herbicides and Water to a Controlled Droplet Applicator."	University of Guelph	To assess the dispersion of herbicides and related weed control.	$5,700 1982-83	In progress. Progress report in December 1982.
PAC 3	"Integrated Management of Snow Mold Diseases of Turfgrasses."	University of Guelph	To evaluate turf management practices and the efficiency of snow mold fungicides.	$8,000 1982-83	In progress. Progress report in December 1982. Successful use of fungicide additives would be useful to control fungicides in the environment.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 4	"Monitoring Dormant Seeds in the Soil to Predict Weed Infestation and Herbicide Needs the Following Year."	University of Western Ontario	To develop a sampling technique and use it to provide an estimate of dormant weed seeds.	$8,800 1982-83	In progress. Progress report in December 1982.
PAC 5	"Behaviour of Aldicarb (Temik$^{(R)}$) in Soil."	University of Western Ontario	To determine: 1. the persistence of seed furrow applications of aldicarb 2. the inability of aldicarb and its oxidation products 3. the persistence of aldicarb residues in potato plants.	$37,200 1980-83	Funds for 1982-83 are $13,300. Progress report in December 1982. The results of this project would provide a better understanding of the persistence of aldicarb in the environment.
PAC 6	"Dislodgeable Pesticides Residues on Turfgreen Foliage in Relation to Safe Re-entry."	University of Guelph	To determine the cultural and climatic influences of common persistence pesticides including human exposure.	$34,500 1981-83	In progress. Progress report available in December 1982. Completion date is 1983.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 7	"Weed Monitoring Techniques for the Detection of Specific Periods of Crop Interference to Reduce or Eliminate Herbicide Usage."	University of Guelph	- To apply various techniques to monitor stress on soybeans resulting from quackgrass. - To determine sublethal doses of selective herbicides. - To find out alternative control of quackgrass to improve soybean yield.	$14,000 1981-83	In progress. Funding for 1982-83 is $9,000. Progress report in December 1982. Completion date is 1983. The project can be grouped in the research category to find alternatives and/or control the use of pesticides, herbicides, etc.
PAC 8	"Determination of the Cause of Poor Efficacy of Insecticides for Control of Rootworms."	University of Guelph	To evaluate the efficiency of pesticides and survey their application rates.	$22,800 1981-83	In progress. Funding for 1982-83 is $15,000. Progress report in December 1982. Completion date is 1983. The project follows the same pattern as above.
PAC 9	"Evaluating Beauveria Bassiana for Biological Control of Seed and Cone Insects in White Spruce."	Canadian Forestry Service	To evaluate the use of fungus as a biological control agent for spruce maggot and seedmoth.	$8,000 1982-83	In progress. Progress report in December 1982. Completion date is 1983. The research falls in the same category for alternatives to chemicals for pest and weed control.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 10	"Feasibility of using the Egg Parasite, Tricogramma minutum Riley, for Biological Control of the Spruce Budworm, choristoneura fumiferana (clemens)."	University of Toronto	To evaluate the release and control of spruce budworm, the environmental effects and the mass production of egg parasites for biological pest control.	$14,260 1982-83	In progress. Progress report is December 1982. Completion date is 1983. This is another project in the research category of alternatives to pesticides.
PAC 11	"Evaluation of Sublethal Effects of Pesticides under Natural and Laboratory Conditions."	University of Guelph	To determine sublethal effects of atrazine and methoxychlor pesticides on the growth and reproduction of some species of zooplankton.	$19,360 1981-83	In progress. Funds for 1983 are $10,220. Progress report in December 1982. Completion date is 1983. The results would be beneficial to standard setting for the two pesticides.
PAC 12	"The Assessment of the Hazards of Formulations of Sevin (carbaryl) to Honeybees, Other Pollinators, and Floral Resources in Ontario."	University of Guelph	To evaluate the effect of carbaryl on useful insects.	$13,500 1982-83	In progress. Progress report in December 1982. Completion date is 1983. This research falls in the same category as Project PAC-11. It can be useful for setting a standard for use of carbaryl.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 13	"Development of a Technique for Monitoring the Variegated Cutworm in Tomatoes in Essex and Kent Counties to reduce Pesticide Damage."	H.J. Heinz Company of Canada	To reduce pesticide damage in tomatoes through monitoring variegated cutworm populations using light traps and other techniques.	$3,500 1982-83	In progress. Progress report in December 1982. Completion date is 1983.
PAC 14	"Biology and Control of Thrips on Cabbage."	University of Guelph	To study and evaluate the economic impact of thrips on cabbage including timing of spraying and thrips build-up and dispersal.	$4,680 1982-83	In progress. Progress report in December 1982. Completion date is 1983. The results can be useful in pest control-abatement activities.
PAC 15	"Losses in Production of Potatoes, Rutabagas and Onions Attributable to Insects, Diseases and Weeds."	University of Western Ontario	To determine losses caused by pests to potatoes, onions, and rutabagas.	$20,800 1981-83	In progress. Funding for 1982-83 is $12,000. Progress report in December 1982. Completion date is 1983. This project deals with the economic impact of pests on 3 vegetables.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 17	"Development of Sex Attractant Traps for Monitoring Changes in Low Density Spruce Budworm Populations as a means of Implementing Early Intervention Management Strategies."	Sault College of Applied Arts and Technology	To evaluate the use of new spruce budworm traps and to correlate trap catches to worm population density.	$35,750 1980-83	In progress. Funding for 1982-83 is $11,550. Progress report in December 1982. Completion date is 1983. Related Project: PAC-10.
PAC 18	"Meadow Mouse Control in Orchards."	Chemical Research International, Toronto	To evaluate the use of bait station and the effectiveness of anticoagulants for long-term control of meadow mice.	$30,000 1981-83	In progress. Funding for 1982-83 is $17,500. Progress report in December 1982. Completion date is 1983. Insufficient information available to comment on.
PAC 19	"Study of the Herbicidal Properties and Environmental Fate of Trichlopyr."	University of Guelph	To determine the mobility and persistence of trichlopyr in soil and compare with the 2-4-5-T and picloram data and evaluate their relative efficiency as herbicides.	$13,000 1982-83	In progress. Might be extended to 1983-84. Progress report in December 1982. The project, in part, deals with the environmental fate of 3 herbicides.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 20	"The Biology and Control of Mosquitoes and Other Biting Flies in Ontario."	University of Guelph	Withdrawn.	-	The 1981 report will be reviewed by PAC.
PAC 21	"Weather-timed Fungicide Schemes for Vegetable Crops."	University of Guelph	To test computerized weather-monitoring devices for timing fungicides to control leaf blight in onions.	$33,000 1980-83	In progress, Funding for 1982-83 is $16,000. Progress report in December 1982. Completion date is 1983.
PAC 22	"Feasibility of Using Parasites and/or Predators in a Program of Integrated Control of the Onion Maggot." (Provincial Lottery Project 42)	University of Western Ontario	- To improve and develop techniques for use of parasites to control onion maggot and apply them to field studies. - To conduct toxicity studies of pesticides on the two parasites.	$39,750 1980-83	In progress. Funding for 1982-83 is $13,450. Progress report in December 1982. Completion date is 1983.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 23	"Influence of Environmental Factors on the Rate of Microbial Degradation of Pesticides in Soil."	University of Western Ontario	To investigate the effect of soil moisture on microbial degradation of two pesticides.	$16,400 1981-83	In progress. Funding for 1982-83 is $8,900. Progress report in December 1982. Completion date is 1983. Microbial degradation of chemicals has been used for treatment of wastes. The results of this project would be helpful in environmental fate studies.
PAC 24	"Integrated Pest Management in Ontario."	Ontario Apple Marketing Commission	To evaluate the response of various orchards to pests and their control.	$22,500 1980-83	In progress. Funding for 1982-83 is $7,500. Additional funds provided by OMAF and OAMC. Progress report in December 1982. Completion date is 1983. The project is a continuation of a previous effort in 1979.
PAC 25	"Efficacy of Alternative Herbicides to Improve Onion Establishment on Muck Soils, as a Substitute for the Loss of Allidochlor."	University of Guelph	To find an alternative herbicide to allidochlor. Field trials of five herbicides will be carried out at Bradford Marsh. Interaction with conditioned seeds will be investigated.	$6,000 1982-84	In progress. Funding for 1982-83 is $6,000. Request for second year funding was indicated. Progress report in December 1982. Completion date is 1984. The project is in progress and it is too early to comment on results.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
PAC 26	"Factors Affecting the Efficacy of Sprays to Control White Mold on White Beans."	University of Guelph	To examine the efficiency of chemical control of white mold of white beans using various fungicides.	$11,935 1981-83	In progress. Funding for 1982-83 is for $6,600. Progress report in December 1982. Completion date is 1983. Comments on this research can be made when completed.
PAC 27	"Evaluation of Adult and Larval Mosquito Sampling Techniques in Ontario."	University of Guelph	To complete a long-term study on the biology and control of mosquitoes and biting flies in Ontario.	$310,000 1976-83	In progress in its seventh year. Funding in 1982-83 is $10,000. This project should be assessed in terms of findings and cost/benefit value.
PAC 28	"The Residues of Metalaxyl in Tobacco Plants, Soils and in the Watershed."	University of Guelph	To monitor metalaxyl and its metabolites in soil and watershed.	$9,000 1982-83	In progress. Progress report in December 1982. Completion date is 1983.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
WR 30	"Effects of Depressed pH on Brook Trout Reproductive Physiology."	University of Western Ontario	To develop a model that will identify normal and abnormal reproductive development of fish in acid sensitive lakes.	$70,000 1981-84	In progress. Funding for 1982-83 is $30,000. Completion date is 1984. Fish collection: MNR.
WR 33	"Development of a Freshwater Fish Test to Identify Aquatic Genotoxic Contaminants."	University of Guelph	To develop an aquatic genotoxic fish test using bioaccumulation of contaminants in receiving water and complex mixtures of wastes.	$45,000 1982-84	In progress. Funding for 1982-83 is $22,000. Completion date is 1984. MOE funding: Hazardous Contaminants Office.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
HC 1	"Suppression of Immune Defences by Halogenated Aromatic Compounds." (Provincial Lottery Project 50)	McMaster University	- To examine the effect of PCB's and PPB's on immune systems and related disease. - To establish effects caused by exposure of mice to PCB and dioxins.	$69,100 1979-83	In progress. Completion date is 1983. Funding: MOE Prov. Lottery $113,100 MOL Prov. Lottery 50,800 MOE H.C. Funds 69,100 Total $233,000
HC 2	"Collaborative Study on Short-Term Tests for Genotoxicity and Carcinogenicity."	York University and MOE	- To participate in a U.N. international study on genotoxicity and carcinogenicity of a group of hazardous chemicals. - To apply above to 6 compounds selected from MOL List of Chemicals of Concern.	$60,000 1982-83	In progress. Completion date is 1983. - To prove the validity of MOE testing capabilities at an international level. - The results obtained on 6 compounds will be used in standard setting, and will complement other MOE projects.
HC 4	"Chemical Identification and Biological Assay Studies of Environmental Mutagens, Promoters and Inhibitors." (Provincial Lottery Project 55)	York University	- To determine mutagenic and carcinogenic activities of hazardous contaminants using newly developed methods. - To determine biohazards of individual and mixtures of contaminants.	$50,000 1982-83	In progress. Completion date is 1984. Additional funding: $402,800 paid by Provincial Lottery Trust Funds. This information is essential for the establishment of health hazards risk, standards and criteria for these chemicals in the total environment.

3a Hazardous Contaminants and their Interaction

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
HC 6	"Experimental and Environmental Modelling Studies of Hazardous Substances in Ontario."	University of Toronto	To study environmental fate of specific toxic substances and devise novel hazard assessment methods. The developed model will be extended to include human exposure.	$52,000 1982-83	In progress. Funding requested for 1983-84 is $55,000. Chemicals selected from MOE List. Standard setting involves: collation of information, knowledge of fate of chemicals, hazard assessment, exposure, risk and criteria. Two of these components are dealt with in this study.
HC 12	"A Biological Model for Partitioning of Mercury, Lead, and Cadmium in Aquatic Systems."	University of Toronto	- To investigate the fate of some toxic metals and their bio-accumulation. - To study the use of algae for biomonitoring of aquatic pollution. - Use the data in a "unit world" microcosm.	$13,000 1982-83	In progress. Completion date is 1983. The following is anticipated: - information on bioaccumulation of 3 metals. - biomonitoring. - fate of metals in the aquatic system.

3b Analytical Procedures

3b Analytical Procedures

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
AR 7	"Synthesis of Polynuclear Aromatic Hydrocarbons of Interest in Environmental Pollution."	York University	To prepare specific PAH's. Samples will be used as standards.	$13,000 1982-84	Funding for 1982-83 is $6,500. Air samples can be used as standards for qualitative purposes only. The study can be complementary to other MOE activities on PAH's.
AR 8	"Long and Short-term Studies of Airborne Pollutants."	Queen's University	To determine short and long-term variations in air pollution using X-ray analysis of aerosol samples.	$42,500 1981-84	Funding for 1982-83 is $14,000. In progress.
AR 10	"Long Range Transport of Aerosols from Satellite Imagery."	York University	To derive images of aerosol movement across the Great Lakes using satellite images.	$27,640 1981-84	Funding for 1982-83 is $13,300. In progress. A useful application of satellite imagery to the transport of aerosol across the Great Lakes.

3b Analytical Procedures

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
AR 2	"Chemical Speciation of Particulate Matter."	McMaster University	To develop procedures for chemical composition of airborne particulate matter using Neutron Activation Analysis.	$36,230 1980-83	Funding for 1982-83 is $15,000. Completion date is 1983. A change has been made to perform speciation-analysis by chemical methods.
AR 3	"Laser Induced Emission Spectroscopy of Polycyclic Hydrocarbons in Low Temperature Matrices."	York University	To develop a laboratory capability to obtain fluorescence spectra of PAH's.	$39,100 1982-85	Funding for 1982-83 is $17,100. In progress. The study is complementary to several MOE projects on PAH's.
AR 4	"Aerosol Analysis System."	University of Toronto	To build a prototype aerosol collection and adsorption systems matched to TAGA (MOE Mobile Mass Spect.).	$65,800 1980-83	Funding for 1982-83 is $26,400. Completion date is 1983. Awaiting final report.

3b Analytical Procedures

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
AR 12	"Methods for the Sampling and Analysis of Nitro-substituted Polycyclic Aromatic Hydrocarbons."	McMaster University	- To synthesize nitro-PAH's and develop analytical methods. - To use above to examine auto exhaust and urban air for the presence of PAH's.	$73,000 1979-83	In progress. Completion date is 1983. Funding for 1982-83 is $26,000. Developed GC/MS analytical methods now in use in MOE Laboratory. PAH's were synthesized for use as standards.
AR 13	"Provision of PAH's and Aza-PAH's as Environmental Analytical Standards."	University of Waterloo	To synthesize PAH's and Aza-PAH's for use as analytical standards.	$43,900 1981-83	In progress. Completion date is 1983. Funding for 1982-83 is $24,000. PAH compounds were prepared and presented to MOE Laboratory for use as standards.
AR 14	"Acid Precipitation Estimation by Indicating Ion Exchange."	Trent University	To develop a method for estimating integrated acid precipitation using ion exchange resins.	$24,200 1981-84	In progress. Completion date is 1984. Funding for 1982-83 is $7,800. Progress report is not available for comment.

3b Analytical Procedures

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
AR 15	"Multielement Determination of Metals and Metal Compounds in Air and Related Samples."	University ot Toronto	To develop analytical techniques for different chemical states of metals using GC-AFS.	$76,500 1979-83	In progress. Completion date is 1983. Funding for 1982-83 is $15,000. Developed methods for mercury. Methods for other metals are planned. Progress report should be reviewed for comment.
AR 16	"Methods for Sampling and Analysis of Asbestos Air Pollution in Ontario."	McMaster University	To obtain and relate data on asbestos in outdoor air using Electron Microscopy and Optical Microscopy.	$75,000 1981-84	In progress. Completion date is 1984. Funding for 1982-83 is $25,000. Methods were developed and verification is in progress.
AR 18	"Organic Airborne Particulate Matter."	Contractor	To develop a field sampling laboratory analytical methodology for PAH and to establish ambient air objectives and guidelines.	$60,000 1981-83	Completion date is 1983. Funding for 1982-83 is $50,000. in cooperation with Ministry of Labour. Progress report is not available for comment and should be reviewed and correlated with other PAH projects.

3b Analytical Procedures

Project	Title	Organization	Purpose	Funding & Duration	Status/Results
WM 1	"Foliar and Soil Analysis of Potting Soils Amended with Compost from the E.R.R.P."	University of Guelph	To apply some of the obtained results of a previous project on container-grown plants and conduct foliar and soil analysis.	$800 1982	This is complementary to a previously completed study.
HC 5	"Evaluation of Pulsed Nuclear Magnetic Resonance Technique in the Analysis of Environmental Samples."	Ryerson Polytechnical Institute	A new NMR instrument will be used to develop methods for the characterization of organic compounds in wastes.	$49,000 1982-83	In progress. Completion date is 1983. A newly developed NMR will be purchased and analytical methods developed. The completed work, training, and the instrument will add to MOL Laboratory capabilities.
HC 8	"To Devise and Implement a Revised Monitoring Scheme for Persistent Toxic Chemicals in Great Lakes Sports Fish."	Contract	To develop and implement new monitoring methods for the characterization of persistent chemicals in Great Lakes fish.	$130,000 1982-84	To be contracted out. An internal component of the project will be carried out in the MOE Laboratory. The Water Resources Branch will provide previous data. This issue is of concern to both Provincial and Federal Governments. 1982-83 cost is $80,000.

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